Method of Test for

# DETERMINING PERCENT WEIGHT OF MSMA CONCENTRATION IN HERBICIDES VIA ICP ATOMIC EMISSION SPECTROMETER

DOTD Designation: TR 521-10

## I. Scope

This method describes the determination of percent weight of MSMA (Monosodium Methane Arsenate) concentration in herbicides.

## II. Apparatus

A. **Analytical balance** – 120 g capacity with accuracy to ±0.0001 g
B. **ICP Atomic Emission Spectrometer**
C. **Volumetric flask**- 100 mL
D. **Pipet** – 1 mL
E. **Herbicide worksheet**
F. **Deionized water bottle**

## III. Reagents

A. **Arsenic Standard Solution**- 100 ppm
B. **Deionized Water**

## IV. Health Precautions

Proper equipment and precautions are to be used whenever toxic samples are used. Use appropriate safety equipment such as safety glasses and gloves. Wash hands frequently. Refer to MSDS of the herbicide for additional precautions.

## V. Sample

Refer to LA DOTD Materials Sampling Manual S 601-99 Section III, Liquid in Drums and Other Containers. Ensure that the sample is stored in a non-metallic, plastic container with a screwed lid.

## VI. Procedure

A. Tare the 100 mL volumetric flask using the analytical balance.
B. Draw a representative portion approximately 0.1 g from the sample of the herbicide.
C. Dispense the representative portion of herbicide from the pipet into the tared 100 ml volumetric flask.
D. Record the weight of the representative portion of the herbicide in the tared 100 mL volumetric flask to the nearest 0.0001 gram on the worksheet as "SW".
E. Add deionized water to the 100 mL volumetric flask, ensuring the meniscus of the diluted test specimen is right at the 100 mL mark of the volumetric flask.
F. Analyze the solution on the ICP Atomic Emission spectrometer according to instruction manual to determine the concentration of arsenic (As) in ppm. Record as "E" on the worksheet.

## VII. Calculations

$$\%MSMA = \frac{E \times DF x 2.16}{SW \times 10000}$$

where,

E = concentration of arsenic (in units of parts per million) obtained by ICP atomic emission spectrometer

DF = the dilution factor (a value assigned for diluting the sample from 0.1 g [equivalent to 0.1mL] into a 100 mL sample)

2.16 = constant, ratio of molecular weight of MSMA to Arsenic's (As) atomic weight

SW = Weight (g) of representative portion of herbicide

10000 = constant (for conversion from ppm ($1x10^{-6}$) to percentage ($1x10^{-2}$)

example:

SW = 0.1389 g
DF = 100
E = 304.3 ppm

$$\%MSMA = \frac{304.3 \times 100 \text{ x } 2.16}{0.1389 \times 10000}$$

$$\%MSMA = \frac{65728.8}{1389}$$

$$\%MSMA = 47.3\%$$

VIII. **Report**

The data shall be reported to nearest tenth percent of MSMA onto the herbicide worksheet (Figure 1).

IX. **Normal Test Reporting Time**

Normal test reporting time is 1 day.

X. **Additional Information**

The ICP Atomic Emission spectrometer can perform elemental analysis of liquid samples. The element that the spectrometer detects within the MSMA test specimen is arsenic (As). MSMA is a molecule that contains arsenic. Therefore, with the concentration of arsenic obtained by the spectrometer, the following ratio can be used to calculate the concentration of MSMA in herbicide samples:

$$2.16 = \frac{161.96\,(\text{Molecular Weight of MSMA})}{74.92\,(\text{Atomic Weight of As})}$$

E = 178 3/99

Louisiana Department of Transportation and Development
Materials & Testing Section

## HERBICIDES (STERILANT OR WEED KILLER)

DOTD TR 520/TR 521

REMARKS 2

| | TEST RESULTS (Max. of 15 characters) | P/F |
|---|---|---|
| | xxxxxxxxxxxxxxxxxxx | xxx |
| TYPE | MSMA | xxx |
| | xxxxxxxxxxxxxxxxxxx | xxx |
| 2, 4-D ACID, % (TR 520) | | |
| MSMA, % (TR 521) | 47.3 | P |

$$\% A = \left(\frac{B \times 0.0221}{C}\right) \times 100$$

0.1 N NaOH mL _____ (B)
Specimen Wt., g _____ (C)

(E x DF x 2.1614) / (SW x 10,000)

As in MSMA , ppm _____ (E)
Dilution Factor _____ (DF)
Specimen Weight, g _____ (SW)

Tested by: JM Date: 3/16/10 Checked by: _____ Date: _____

APPROVED by: ENGINEER Date: 3/16/10

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**Figure 1**